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**DEPARTMENT:** PHARMACOLOGY

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**QUESTION:** 1. Briefly discuss the cyclic changes in any two of the following:

1. Cervix
2. Vagina
3. Breasts

2. explicate anyone of the following:

a. Menstrual cycle

b. hormonal regulation of menstrual cycle.

1. Cyclic changes in breasts: Each month, women go through changes in the hormones that make up the normal menstrual cycle. The hormone estrogen is produced by the ovaries in the first half of the menstrual cycle. It stimulates the growth of milk ducts in the breasts. The increasing level of estrogen leads to ovulation halfway through the cycle. Next, the hormone progesterone takes over in the second half of the cycle. It stimulates the formation of the milk glands. These hormones are believed to be responsible for the cyclical changes that many women feel in their breasts just before menstruation. These include swelling, pain, and soreness. During menstruation, many women also have changes in breast texture. Their breasts may feel very lumpy. This is because the glands in the breast are enlarging to get ready for a possible pregnancy. If pregnancy does not happen, the breasts go back to normal size. Once menstruation starts, the cycle begins again.
2. Cyclic changes in cervix: The cervix acts as a barrier that limits access to the uterine cavity.
* During the follicular phase, increasing estradiol levels increase cervical vascularity and edema and cervical mucus quantity, elasticity, and salt (sodium chloride or potassium chloride) concentration. The external os opens slightly and fills with mucus at ovulation.
* During the luteal phase, increasing progesterone levels make the cervical mucus thicker and less elastic, decreasing success of sperm transport.
* Menstrual cycle phase can sometimes be identified by microscopic examination of cervical mucus dried on a glass slide; ferning (palm leaf arborization of mucus) indicates increased salts in cervical mucus. Ferning becomes prominent just before ovulation, when estrogen levels are high; it is minimal or absent during the luteal phase. Spinnbarkeit, the stretchability (elasticity) of the mucus, increases as estrogen levels increase (eg, just before ovulation); this change can be used to identify the periovulatory (fertile) phase of the menstrual cycle.

2. Explicit the menstrual cycle

Menstruation is the periodic discharge of blood and sloughed endometrium (collectively called menses or menstrual flow) from the uterus through the vagina. It is caused by the rapid decline in ovarian production of progesterone and estrogen that occurs each cycle in the absence of a pregnancy. Menstruation occurs throughout a woman’s reproductive life in the absence of pregnancy.

[Menopause](https://www.msdmanuals.com/professional/gynecology-and-obstetrics/menopause/menopause) is the permanent cessation of menses.

Average duration of menses is 5 (± 2) days. Blood loss per cycle averages 30 mL (normal range, 13 to 80 mL) and is usually greatest on the 2nd day. A saturated pad or tampon absorbs 5 to 15 mL. Menstrual blood does not usually clot (unless bleeding is very heavy), probably because fibrinolysin and other factors inhibit clotting.

The median menstrual cycle length is 28 days (usual range, about 25 to 36 days). Generally, variation is maximal and intermenstrual intervals are longest in the years immediately after menarche and immediately before menopause, when ovulation occurs less regularly. The menstrual cycle begins and ends with the first day of menses (day 1).

The menstrual cycle can be divided into phases, usually based on ovarian status. The ovary proceeds through the following phases:

* Follicular (preovulatory)
* Ovulatory
* Luteal (postovulatory—[The idealized cyclic changes in pituitary gonadotropins, estradiol (E2), progesterone (P), and uterine endometrium during the normal menstrual cycle](https://www.msdmanuals.com/professional/gynecology-and-obstetrics/female-reproductive-endocrinology/female-reproductive-endocrinology#v1061623))

The [endometrium](https://www.msdmanuals.com/professional/gynecology-and-obstetrics/female-reproductive-endocrinology/female-reproductive-endocrinology#v1061633) also cycles through phases.

**Follicular phase**

This phase varies in length more than other phases.

In the **early follicular phase** (first half of the follicular phase), the primary event is

* Growth of recruited follicles

At this time, the gonadotropes in the anterior pituitary contain little LH and FSH, and estrogen and progesterone production is low. As a result, overall FSH secretion increases slightly, stimulating growth of recruited follicles. Also, circulating LH levels increase slowly, beginning 1 to 2 days after the increase in FSH. The recruited ovarian follicles soon increase production of estradiol; estradiol stimulates LH and FSH synthesis but inhibits their secretion.

During the **late follicular phase** (2nd half of the follicular phase), the follicle selected for ovulation matures and accumulates hormone-secreting granulosa cells; its antrum enlarges with follicular fluid, reaching 18 to 20 mm before ovulation. FSH levels decrease; LH levels are affected less. FSH and LH levels diverge partly because estradiol inhibits FSH secretion more than LH secretion. Also, developing follicles produce the hormone inhibin, which inhibits FSH secretion but not LH secretion. Other contributing factors may include disparate half-lives (20 to 30 minutes for LH; 2 to 3 hours for FSH) and unknown factors. Levels of estrogen, particularly estradiol, increase exponentially.

**Ovulatory phase**

Ovulation (ovum release) occurs.

Estradiol levels usually peak as the ovulatory phase begins. Progesterone levels also begin to increase.

Stored LH is released in massive amounts (LH surge), usually over 36 to 48 hours, with a smaller increase in FSH. The LH surge occurs because at this time, high levels of estradiol trigger LH secretion by gonadotropes (positive feedback). The LH surge is also stimulated by GnRH and progesterone. During the LH surge, estradiol levels decrease, but progesterone levels continue to increase. The LH surge stimulates enzymes that initiate breakdown of the follicle wall and release of the now mature ovum within about 16 to 32 hours. The LH surge also triggers completion of the first meiotic division of the oocyte within about 36 hours.

**Luteal phase**

The dominant follicle is transformed into a corpus luteum after releasing the ovum.

The length of this phase is the most constant, averaging 14 days, after which, in the absence of pregnancy, the corpus luteum degenerates.

The corpus luteum secretes primarily progesterone in increasing quantities, peaking at about 25 mg/day 6 to 8 days after ovulation. Progesterone stimulates development of the secretory endometrium, which is necessary for embryonic implantation. Because progesterone is thermogenic, basal body temperature increases by 0.5° C for the duration of this phase.

Because levels of circulating estradiol, progesterone, and inhibin are high during most of the luteal phase, LH and FSH levels decrease. When pregnancy does not occur, estradiol and progesterone levels decrease late in this phase, and the corpus luteum degenerates into the corpus albicans.

If implantation occurs, the corpus luteum does not degenerate but remains functional in early pregnancy, supported by human chorionic gonadotropin that is produced by the developing embryo.

The idealized cyclic changes in pituitary gonadotropins, estradiol (E2), progesterone (P), and uterine endometrium during the normal menstrual cycle

Days of menstrual bleeding are indicated by M.

FSH = follicle-stimulating hormone; LH = luteinizing hormone.

